

# INTRODUCTION



# Overview

*Exploring Bioethics* supports high school biology teachers in raising and addressing bioethical issues with their students and engages students in rigorous thinking and discussions. By providing conceptual guidelines that promote careful thinking about difficult cases, it stresses the importance of presenting thoughtful and relevant reasons for considered positions on ethical issues.

Module 1, *Bioethics Concepts and Skills*, lays the groundwork for subsequent modules by

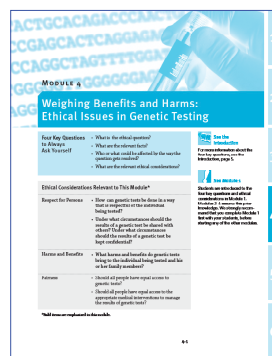
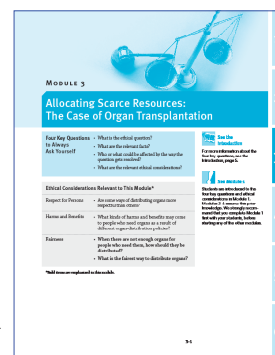
emphasizing the importance of giving reasons for ethical choices. Students examine two cases about the use of enhancements in sports that raise ethical questions. In the process, they acquire strategies for analyzing and discussing bioethical cases more generally. They develop habits of mind that include asking the following four key questions to clarify the issues involved in making an ethical decision:

- **What is the ethical question?**
- **What are the relevant facts?**
- **Who or what could be affected by the way the question gets resolved?**
- **What are the relevant ethical considerations?**

The last key question focuses students on a set of core ethical considerations that highlight the important ethical aspects of any case. *Exploring Bioethics* draws on three widely recognized ethical considerations:

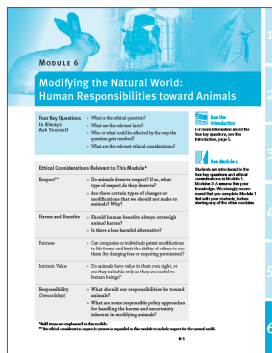
- **Respect for persons:** Not treating someone as a mere means to a goal or end.
- **Minimizing harms while maximizing benefits:** Acting to lessen negative outcomes and promote positive outcomes.
- **Fairness:** Ensuring that benefits, resources, and costs are shared equitably.

Although this supplement focuses on these three ethical considerations, others may be relevant to a particular case. For example, Module 1 encourages students to also think about authenticity in sports, and Module 6 adds the ethical consideration of stewardship (or responsibility toward other species).



Modules 2 through 6 highlight cases that represent key topics in bioethics. These modules give students the chance to apply their understanding of the four key questions and ethical considerations to a wide variety of ethical issues in the life sciences. Teachers can use each module as a stand-alone, three-day unit of instruction or as part of another unit.

The intent of *Exploring Bioethics* is not to change opinions or perspectives, but rather to strengthen students' ability to consider, explain, and offer a reasoned defense of their points of view. Within the modules, there is a special emphasis on the importance of providing relevant reasons for a position. A strong reason, what



bioethicists often call a strong *justification*, is one that addresses the four key questions and takes the core ethical considerations into account. This sets ethical analysis apart from “gut reactions.” The

activity of assessing different reasons, considering counterarguments, and providing a strong justification for a particular position is a cornerstone of the modules.

All the modules in *Exploring Bioethics* make explicit links between the concepts and skills used in bioethical analysis and the scientific content taught to students, thereby motivating students to use and

apply scientific concepts. The modules align well with important topics taught in introductory biology courses, such as genetics, immunology, organ systems, scientific reasoning, and experimental design. Many of the questions considered are practical issues that students are likely to face in their lives. A major goal of these modules is to enable students to be more responsible and thoughtful decision makers in a world of ever-increasing complexity.

# Teaching *Exploring Bioethics*

## WHAT IS BIOETHICS?

### Defining Ethics and Bioethics

The definition of ethics reflected in *Exploring Bioethics* is

*Ethics seeks to determine what a person should do, or the best course of action, and provides reasons why. It also helps people decide how to behave and treat one another, and what kinds of communities would be good to live in.*

Ethics is the activity of deciding what one should do, as an individual and a member of a community. Members of a democratic society must offer each other reasons that show why one way of dealing with a problem is better than another. Ethics is the activity of offering reasons to support a decision about what one should do.

Bioethics is a subfield of ethics that explores ethical questions related to the life sciences. Bioethical analysis helps people make decisions about their behavior and about policy questions that governments, organizations, and communities must face when they consider how best to use new biomedical knowledge and innovations.

### How Are Bioethical and Scientific Questions Different?

The major difference between bioethical and scientific inquiry is that scientists seek to understand phenomena in the world—they want to describe what *is*—while bioethicists seek to figure out what people *should do*. This is an oversimplification, but by emphasizing the difference between the words *is* and *should*, you can help students grasp a main difference between scientists, who seek to describe and understand the natural world, and ethicists, who seek to determine what the best course of action should be.

Thus, a scientist might ask, “What are the physical risks of using steroids?” while an ethicist might ask, “Should athletes be allowed to use steroids?” Or, a scientist might ask, “How can we genetically modify a mouse to produce human antibodies for use as therapeutics?”—as has been done to develop treatments for colorectal

cancer, rheumatoid arthritis, and asthma. An ethicist might ask, “*Should* we modify a mouse so that it can produce human antibodies?”

Ethical questions are also different from legal questions and from questions of personal preference, custom, or habit. You can find more information about how ethical questions differ from other kinds of inquiry under “Key Question: What Is the Ethical Question?” on page 5.

## WHY TEACH BIOETHICS?

Advances in the life sciences are giving humans new capacities. New medicines, biomedical procedures, and ways of altering plants and animals are bringing benefits to millions of people. However, these same innovations also have the potential to bring harms or to raise other kinds of ethical questions about their appropriate use. All citizens—and certainly your students as they reach maturity in the next decades—will confront questions such as these:

- Is it okay to take steroids to enhance sports performance? How are they different from a high-protein diet or vitamins? How should I decide which ways of enhancing my natural abilities are permissible?
- Should I take a genetic test to determine whether I carry the gene for an illness I know is eventually fatal but there is little I could do to prevent? If I find out that I carry it, should I tell my siblings or my spouse?

Many of the questions students will confront, like the ones above, have to do with decisions individuals will have to make about their own lives. Other questions have to do with decisions groups will have to make that affect the lives of many individuals. These are *public policy* decisions. For example,

- Should vaccinations for all students be mandatory, even when some parents object?
- What is the fairest way to distribute lifesaving, but scarce, organs to the thousands of people who need them?

People face all these questions today. As you familiarize yourself with this curriculum supplement, you will be equipped with concepts, cases, fact sheets, and

teaching strategies that will help you and your students examine these questions and others like them. The modules' activities invite your students to grapple with new questions that no one can predict now but that society is most assuredly going to have to contend with over the coming decades, as biomedical science continues to advance.

## Four Important Reasons to Teach Bioethics

### 1. Advance students' science understanding.

Teaching bioethics can serve as a way to teach science to students who otherwise might not be engaged with the subject. Bioethics provides a real-world context for introducing and underscoring the “need to know” science concepts. Case studies help students see the relevance of the science content they are learning and motivate them to apply their science understanding to issues of social relevance. Bioethics may also inspire students to gain a deeper understanding of the scientific facts so they can make well-reasoned ethical arguments.

Bioethical issues interest students across a range of learning abilities and inclinations. The National Science Education Standards point to the need for students to understand the role of science in society and to recognize how science influences and is influenced by economic, political, and social issues (National Research Council 1996). National standards also ask that students be able to understand and evaluate costs and benefits associated with technological advances.

### 2. Prepare students to make informed, thoughtful choices.

Studying bioethics is a way to deepen students' understanding of medical research and its impact on society. Biomedical and clinical research has led to dramatic breakthroughs in the understanding of disease and disease prevention as well as new treatments. New knowledge requires a citizenry capable of making informed decisions to guide personal choices *and* public policy. This supplement gives students an opportunity to prepare for the scientific, medical, ethical, personal, and public-policy choices they will face as adults in the 21st century.

### 3. Promote respectful dialogue among people with diverse views.

Engaging in bioethics discussions helps develop students' ability for reasoned dialogue, especially among students with different perspectives. It also encourages students to think about choices from a variety of viewpoints and interests, thus facilitating respectful discussions of potentially contentious issues. These skills are fundamental for an effective democracy.

### 4. Cultivate critical-reasoning skills.

Bioethics activities emphasize the importance of justification, a process of giving reasons for views. Research indicates that people have more difficulty reasoning in the ethical domain than in any other. Even many adults tend to rely on rules and often resist delving deeply to consider the reasons for the rules, or to see whether there are ever appropriate exceptions. Others believe that moral truths are wholly subjective, resistant to reasoned analysis, and that any one opinion is as good as any other. *Exploring Bioethics* gives students the chance to develop their ethical reasoning skills so that they can critically analyze problems in a more careful and nuanced way.

## THINKING LIKE A BIOETHICIST

*Exploring Bioethics* aims to help students develop the skills and confidence to handle a wide array of ethical issues—now and in the future—as patients, family members, citizens, and possible policy makers. The major approach of the supplement, summarized below and presented in detail in Module 1, is to help students begin to think like bioethicists by presenting some of the concepts and procedural methods bioethicists use.

First, a caveat: the phrase “thinking like a bioethicist” might imply that there is a single way to approach ethical questions, but nothing could be further from the truth. Just as there is no one way to do science, there is no one way to do ethical analysis. Nevertheless, there are key concepts and skills on which bioethicists tend to rely.

## Concepts and Skills in Bioethics

This curriculum supplement presents a set of **four key questions** that can be used to clarify an ethical problem. It encourages students to develop the habit of mind (or skill) to always ask the following four questions whenever they face an ethical choice:

- What is the ethical question?
- What are the relevant facts?
- Who or what could be affected by the way the question gets resolved?
- What are the relevant ethical considerations?

Answers to the last question include the ethical considerations that are most relevant in a given case and how they are relevant. *Exploring Bioethics* encourages students to consider the relevance of three widely recognized considerations whenever they confront an ethical choice:

- respect for persons
- minimizing harms while maximizing benefits
- fairness

Many other ethical considerations exist, such as authenticity, responsibility, and intrinsic value. Students will use these considerations to come to decisions about the best course of action in a given case.

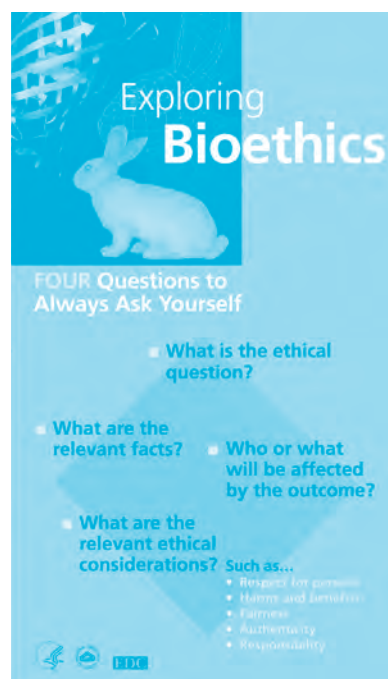
The supplement encourages students to answer all four key questions fully and comprehensively and then, in light of their responses, to come to a decision or recommendation about the ethical question raised in the cases they explore. The purpose is not to encourage group consensus, but rather to encourage each student to develop his or her own point of view based on careful reasoning. Students should refer to these questions and considerations in the justifications they provide about why their decision is the best one.

Figure 1 shows the poster that summarizes the key questions and considerations that form the inner “architecture” of the approach taken in *Exploring Bioethics*. Whenever you teach one of the modules, consider displaying the poster in your classroom and drawing students’ attention to it.

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**Figure 1.** The *Exploring Bioethics* poster reminds students that sound justifications in bioethics require attention to four key questions and to relevant ethical considerations.

## FOUR KEY QUESTIONS TO ALWAYS ASK YOURSELF

It is important to note that these key questions *do not always have to be asked in a specific order*. Sometimes, the facts of the case will illuminate the critical ethical question. Similarly, thinking about stakeholders and their concerns can bring the relevant facts into focus. The process of ethical reasoning is fluid and can evolve as students consider a case more deeply.

### Key Question: What Is the Ethical Question?

Identifying ethical questions is a two-part skill.

1. **The ability to see the ethical dimensions of a given situation.** Ethicists often refer to this skill as *moral imagination* or *moral sensitivity*, which is the ability to detect that there are ethical issues at stake. This ability keeps people from simply gliding over the surface of a situation and missing its ethical implications. Fortunately, people can develop this skill with practice.



**2. The ability to *distinguish* an ethical question from other kinds of questions, such as legal, scientific, or personal-preference ones.** People often confuse these different kinds of questions, because they are related. For example, in deciding whether to ban steroids (an ethical question), one would want to know how safe they are (a scientific question). But fundamentally, scientific and ethical questions are different, because they have different purposes and rely on different kinds of evidence for their answers. Ethical questions are also different from legal ones and from questions of personal preference, custom, or habit.

People often have a particularly hard time discerning legal from ethical questions—but keeping them separate when undertaking an ethical analysis is important. Ethical analyses should take the legal context and local laws into consideration. However, something can be illegal yet ethical. Conversely, something can be legal but unethical. With respect to enhancement and sports, some interventions could be considered unethical even if they are not yet illegal. Another difference is that the law typically sets the minimum standards to which people must adhere; ethical standards sometimes focus on ideals (more than the minimum), encouraging people to act virtuously. Although they influence each other, the law and ethics are separate enterprises.

Perhaps hardest of all to distinguish are personal-preference and ethical questions—indeed, these two realms are often confused. The culture you live in might prefer a high degree of privacy in the doctor’s office, while your friend from another culture would be unaccustomed to a private office and willing to discuss his medical affairs publicly. Your cultural attitudes toward privacy are matters of preference, custom, or habit, but they are not ethical matters. A key distinguishing feature of an ethical question—as opposed to a question of personal preference, custom, or habit—is that it typically arises when individuals or groups might be harmed, disrespected, or unfairly disadvantaged.

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*Ethical questions are different from scientific and legal ones and from questions of personal preference, custom, or habit.*

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If no one is harmed or disadvantaged by the two kinds of medical settings, then the amount of privacy in each would not be an ethical issue; however, it could become an ethical issue. For example, assume there is a patient who values privacy and yet the healthcare providers ignore this person’s wishes. Ignoring the privacy wishes of someone who values privacy would transform the matter from one of personal preference into ethics, because disregarding what someone values is a form of disrespect.

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## **Key Question: What Are the Relevant Facts?**

Once an ethical question has been chosen, students are asked to identify the facts necessary to think carefully about it. Which scientific facts are important? Which social science facts? Are other facts needed to make a better decision?

**Scientific facts are important, and they provide a critical link between bioethics and the biology curriculum.** They are especially important for answering questions about harms and benefits. Before students can make a reasoned judgment about vaccination policies, for example, they need to know about the risks of getting a disease, the magnitude of harm that could occur if the disease is contracted, and the risk of suffering that harm, as well as the efficacy and side effects of the vaccines. When examining issues surrounding genetic testing, students need to be able to understand facts related to inheritance of traits and whether medicine has anything to offer to prevent the diseases that the tests diagnose.

**Social science facts are equally important.** What psychological, sociological, anthropological, historical, and economic facts and concepts are needed to understand the available choices? The social sciences can tell us how people may respond to disease, health-promotion medicines, or their physician’s advice, and they can provide insight into differences among groups in the view of what is ethically important and the impact of



a given decision. Historical information can illustrate how people handled ethical decisions in the past, while economic information can help anticipate costs for different stakeholders.

It is sometimes impossible to make a complete inventory of *all* the relevant facts of a case, and students should realize that decisions must sometimes be made when information is incomplete. However, if key pieces of information necessary to make a good decision are missing, students could conduct additional research. They should consider new facts as they uncover them and address the implications of the emerging evidence in their analysis of the ethical case.

### **Key Question:** **Who or What Could Be Affected by the Way the Question Gets Resolved?**

The purpose of reflecting on this question is to ensure that students think about the range of individuals, groups, or institutions that may have a stake in the outcome of an ethical situation and how these stakeholders may be affected by the decision. For example, students can consider how stakeholders are affected physically, emotionally, and economically by a decision. Stakeholders are not always human beings or human organizations; ethical decisions might also affect animals, plants, organisms, or the environment. Often, students will discover that the impact of a decision or policy affects many more people and kinds of stakeholders than they expected initially.

Students have the opportunity to practice thinking about how various solutions affect other people, thereby deepening their ability to see things from multiple perspectives. Considering stakeholders gives students a chance to “be in someone else’s shoes.” By identifying the concerns and priorities that different stakeholders bring to an issue, students can also enlarge their understanding of the broader context of an ethical problem. If it is not possible to protect the interests of all the stakeholders, students will have to prioritize—and provide a justification to favor—the interests of certain stakeholders over others. Ultimately, students may also need to grapple with which stakeholders should have decision-making power and how they should share this power.

### **Key Question:** **What Are the Relevant Ethical Considerations?**

As noted above, bioethicists often reason out which choice is best by taking the core ethical considerations (respect for persons, minimizing harms while maximizing benefits, and fairness) and others (such as authenticity and responsibility) into account. The next section describes each of the three core considerations and mentions several other considerations. Each consideration is very important because each one is a different way to honor the moral standing of persons.

## **CORE AND OTHER ETHICAL CONSIDERATIONS**

### **Respect for Persons**

Respect for persons means not treating someone as a means to an end or goal. For example, even if one person’s organs could help five people live, it would be an ethical violation of respect for persons to kill that one person and distribute the organs to save the five who need them.

Respect for persons is also often a matter of not interfering with a person’s ability to make and carry out decisions. In some cases, it is also a matter of enabling a person to make choices or supporting them in the choices they make.

Respect means more than just listening to another person; it means hearing and attempting to understand what other people are trying to say. It also means not belittling or making fun of thoughts or feelings or perspectives that other people hold.

### **Minimizing Harms While Maximizing Benefits**

This core ethical consideration focuses on trying to promote positive consequences by balancing harms (or burdens) and benefits. In doing so, one must consider which actions would do the least harm and provide the most benefit. This emphasis is central to the ethical approach known as *utilitarianism*. The root word in utilitarianism is *utility*, which refers to the positive uses (benefits or utilities) that will come about as a conse-

quence of choosing one path over another. Harms and benefits come in a variety of types, including physical, emotional, economic, and social, to name a few. Utilitarians consider all types of harms and benefits in their ethical deliberations.

“First of all, do no harm” is a familiar expression of minimizing harms when practicing medicine. Even if physicians cannot help a patient directly, they should try to avoid actions that cause harm. “Do no harm” is sometimes referred to as *nonmaleficence*. A closely related concept, *beneficence* (“Do good”), stresses acting in the best interest of others and being of benefit to them.

## Fairness

Students bring an inherent understanding of the concept of fairness to the classroom. Even very young children can be heard voicing their opinions on whether an action is fair or not. Fairness is an important aspect of justice. The consideration of fairness asks us to ensure that resources, risks, and costs be distributed equitably. The question of how to fairly allocate a benefit or a burden is a question of *distributive justice*. When such questions are applied within society at large, the question is one of *social justice*.

There are many acceptable ways to figure out what would be fair. Sometimes what is fair is giving each person an equal amount of something. Other times, it is providing according to each person’s need or according to each person’s merit or contribution. Please note that fairness does not necessarily entail equal shares; it usually depends on other factors, too.

## Other Ethical Considerations

In addition to the three common and very important core ethical considerations discussed in this supplement, many other considerations can be equally important depending on the nature of the ethical choices. Examples addressed in *Exploring Bioethics* include the concepts of authenticity in individual achievement, responsibilities of individuals to their community and to the natural world, and the intrinsic value of animals.

## Weighing Ethical Considerations

Students will discover that sometimes these ethical

considerations clearly point out how best to act, while at other times they conflict and cannot all be satisfied. Sometimes it is not easy or even possible to act in accordance with all the relevant considerations at the same time.

For example, you might want to show respect for your grandmother by allowing her to continue driving, even when her eyesight is failing, but to minimize harm, you might feel a responsibility to take her keys away. In a case like that, it’s hard both to show respect for her desire to move around freely *and* to protect her and others from the harm that might be caused by a car accident. Which of these core ethical considerations should count more (**respect for persons**, which motivates you to allow her to keep driving, or **minimizing harms**, which motivates you to take her keys away)? How should you decide?

When an ethical problem arises, each individual may prioritize and choose which considerations should be favored in a different way. Often, there is no one right answer. In addition, people can emphasize different ethical considerations in the process of ethical analysis but arrive at the same decision about what should be done.

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## BUILDING AND ASSESSING STRONG JUSTIFICATIONS

Once bioethicists have clearly stated the ethical question, collected all the facts, anticipated the likely stakeholders, and thought about the options in terms of the relevant ethical considerations, they are ready to make a decision or recommendation. But this is only part of the process. Sound ethical reasoning requires that people *explain* their recommendation: *Why* is your decision the best decision or the best recommendation? This is the part of ethical reasoning called *justification*. An important aspect of this curriculum supplement is assessing the strength of students’ justifications—as shown in **Table 1** on pages 10 and 11—so they can build more effective arguments and counterarguments. (An argument includes both the student’s recommendation and the justification for that recommendation.)

## Building Strong Justifications

When exploring bioethics with your students, a large part of your job will be eliciting students' reasons for their positions. There are many ways to encourage deep reflection about one's reason for holding a particular view. First, of course, you can simply remember to ask students, "Why? Why do you hold that view?" But there are other phrases and strategies that you can use to encourage students to deeply consider—and reveal—their thinking processes. Sample dialogues are in **Table 2** (pages 16–19), as well as within the modules themselves.

Of course, one's reasons should include a description of the most relevant ethical considerations and should show how the recommended course of action takes those considerations into account. It should also describe alternative decisions that may have been considered and why they were rejected.

### Elements of a strong justification include

- high degree of relevance to the ethical question;
- reference to the most important science and social science facts;
- description of the potential effects of a decision on others;
- identifying and applying the relevant core ethical considerations;
- analysis of the ways the recommended course of action satisfies those considerations and of the strengths and weaknesses of other solutions; and
- logical reasoning (conclusion follows from the reasons given).

### Elements of a weak justification include

- errors in the facts of the situation or the history surrounding a case (errors in the science or social science content);
- errors in understanding or applying a core ethical consideration (mistakes of interpretation of core ethical considerations); and
- errors in logic (the conclusion does not follow from the reasons given).

**The strongest justifications are those that give the best possible reasons for a particular conclusion and responses to counterarguments.** Many students will be familiar with the skills needed to write a persuasive essay for language arts classes. You may wish to emphasize that an ethical justification is similar to a persuasive essay, except that the justification also focuses on bioethical concepts and considerations.

*Exploring Bioethics* presents many ethics cases where there is no one right answer. Students are challenged to think hard about questions over which reasonable people can disagree. The final assessment activities do not evaluate whether students came down on one side of the issue or another, but rather evaluate the quality of the justifications they provided for their choice.

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## Assessing Student Justifications

In Module 1, students consider the elements that contribute to a strong justification and practice evaluating justifications. Subsequent modules reinforce those elements.

Like many of your colleagues, you may feel reluctant to assess something that seems as subjective as a student's position on an ethical issue. The capacity to give feedback that enhances students' ability to build justifications grows with experience.

You can assess the quality of students' justifications using the guidelines in Table 1 (pages 10–11). It is important to assess additional factors during a discussion, such as the ability to address one another respectfully.

TABLE 1. ASSESSING STUDENT JUSTIFICATIONS

Element	Exemplary	Proficient	Partially Proficient	Developing
<b>Relevance to the Ethical Question</b>	<ul style="list-style-type: none"> <li>The justification strongly relates to resolving the ethical question.</li> </ul>	<ul style="list-style-type: none"> <li>The justification relates clearly to resolving the ethical question.</li> </ul>	<ul style="list-style-type: none"> <li>The justification references the ethical question but may not directly address it or attempt to resolve it.</li> </ul>	<ul style="list-style-type: none"> <li>The justification either does not reference the ethical question or does so inaccurately.</li> </ul>
<b>Reference to the Important Science and Social Science Facts</b>	<ul style="list-style-type: none"> <li>Factual information relevant to the case is thoroughly described.</li> <li>Additional important information is clearly identified.</li> <li>The student demonstrates a solid understanding of the context of the case and can distinguish between relevant and irrelevant facts.</li> </ul>	<ul style="list-style-type: none"> <li>Factual information relevant to the case is described.</li> <li>Additional important information is clearly identified.</li> </ul>	<ul style="list-style-type: none"> <li>Factual information relevant to the case is described, but some key facts may be missing.</li> <li>Additional important information is identified but may be partially incomplete.</li> </ul>	<ul style="list-style-type: none"> <li>Factual information relevant to the case is incompletely described or is missing.</li> <li>Additional important information is missing.</li> </ul>
<b>Reference to the Potential Effects of a Decision on Others</b>	<ul style="list-style-type: none"> <li>A thorough and insightful description of the major stakeholders and their interests, concerns, and priorities is presented.</li> <li>The ways stakeholders could be affected by how the situation is resolved are considered in depth.</li> </ul>	<ul style="list-style-type: none"> <li>A description of the major stakeholders and their interests, concerns, and priorities is presented.</li> <li>The ways stakeholders could be affected by how the situation is resolved are considered in depth.</li> </ul>	<ul style="list-style-type: none"> <li>A description of the major stakeholders and their interests, concerns, and priorities is presented, but a few major stakeholders may be missing.</li> <li>The ways stakeholders could be affected by how the situation is resolved are considered for most of the stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>Stakeholders are either not identified or are misrepresented.</li> <li>The interests, concerns, and priorities of the stakeholders may be incomplete or missing for many stakeholders.</li> <li>The ways stakeholders stand to be affected by how the situation is resolved are incomplete or missing.</li> </ul>

*Continued*

Element	Exemplary	Proficient	Partially Proficient	Developing
<b>Reference to Relevant Ethical Considerations</b>	<ul style="list-style-type: none"> <li>• The justification makes connections to all relevant ethical considerations.</li> <li>• The justification makes insightful connections to selected ethical considerations, demonstrating deep understanding.</li> </ul>	<ul style="list-style-type: none"> <li>• The justification makes connections to some of the relevant ethical considerations.</li> <li>• The justification makes connections to ethical considerations, demonstrating understanding and using terms appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>• The connection to relevant ethical considerations is not clearly stated.</li> <li>• The connections mentioned demonstrate some misunderstanding of particular ethical considerations.</li> <li>• Terms may occasionally be used inaccurately.</li> </ul>	<ul style="list-style-type: none"> <li>• The connection to relevant ethical considerations is incomplete or inaccurate.</li> <li>• The connections mentioned demonstrate misunderstanding of particular ethical considerations.</li> <li>• Terms are used inaccurately.</li> </ul>
<b>Generating Solutions and Justifications</b>	<ul style="list-style-type: none"> <li>• One or more possible solutions are generated.</li> <li>• For each solution, a strong justification for and a strong one against are developed. The justifications skillfully and insightfully draw on the facts of the case as well as all the relevant ethical considerations.</li> </ul>	<ul style="list-style-type: none"> <li>• One or more possible solutions are generated.</li> <li>• For each, a justification for and one against are developed. The justifications draw on the facts of the case as well as all or most of the relevant ethical considerations.</li> </ul>	<ul style="list-style-type: none"> <li>• One or more possible solutions are generated, but the justifications are incomplete.</li> <li>• The facts of the case may not be referenced, and ethical considerations may be missing in the discussion.</li> </ul>	<ul style="list-style-type: none"> <li>• Solutions are either incomplete or missing.</li> <li>• The facts of the case are not referenced, and ethical considerations are not discussed.</li> </ul>
<b>Thoughtful and Logical Reasoning</b>	<ul style="list-style-type: none"> <li>• The selected option is strongly justified, and the conclusion flows logically from the premises presented.</li> <li>• The justification demonstrates deep and thoughtful consideration of the topic.</li> <li>• The justification demonstrates exceptionally organized thinking; writing builds naturally to a strong conclusion.</li> </ul>	<ul style="list-style-type: none"> <li>• The selected option is clearly justified, and the conclusion flows from the premises presented.</li> <li>• The justification demonstrates consideration of the topic.</li> <li>• Thinking is clear and organized.</li> </ul>	<ul style="list-style-type: none"> <li>• The selected option is justified, but the conclusion may not flow logically from the premises presented.</li> <li>• The justification demonstrates awareness of the topic but little reflection on it.</li> <li>• Thinking is somewhat clear and organized.</li> </ul>	<ul style="list-style-type: none"> <li>• The selected option is not clearly identified, is incompletely justified, or is not justified at all. The conclusion may be missing or may not flow logically from the justification.</li> <li>• The justification demonstrates little or no consideration of the topic.</li> <li>• Thinking is confused, disorganized, or stays at a very superficial level.</li> </ul>

Source: Adapted with permission from materials developed by the Northwest Association for Biomedical Research (NWABR).



## CHALLENGES IN TEACHING BIOETHICS AND HOW EXPLORING BIOETHICS CAN HELP

*Exploring Bioethics* offers several strategies for overcoming the challenges in teaching bioethics successfully.

### Challenge #1: Science Teachers Lack Background in Bioethical Analysis

The nature of evidence is different in scientific and ethical inquiry. Most science educators have been trained only in how to build scientific justifications, which are based primarily on empirical evidence. Ethical justifications require empirical evidence (from both the sciences and social sciences), too, but in addition, one must take a set of important ethical considerations into account. Thus, teaching bioethics requires a shift in the paradigm that both science teachers and their students are accustomed to using.

Unless they have taken courses in ethics, science teachers may not have been exposed to some of the concepts and procedures ethicists use and, therefore, may feel unprepared to conduct, facilitate, and teach ethical analysis in the classroom.

#### How *Exploring Bioethics* Can Help

To address this challenge, *Exploring Bioethics* focuses attention on the four key questions and core ethical considerations described above. You will introduce these questions and considerations in Module 1, and students will repeatedly apply them in the subsequent modules. Easy to remember, they allow students to enter into rich conversations that do not oversimplify the ethical issues. The key questions and core ethical considerations serve as a framework for student thinking in the ethical domain. As they work through different modules, students should develop the habit of always asking these questions when confronted with ethical choices.

If you wish to read more about bioethics and the teaching of bioethics, see the Resources for Teaching Bioethics listed on page 20 of this Introduction. Also, be sure to go to the *Exploring Bioethics* Web site, where you will find many helpful teacher support materials and updates that will enhance your ability to teach this supplement (<http://science.education.nih.gov/supplements/bioethics>).

### Challenge #2: Many People Have Trouble Thinking Critically about Ethical Issues

Research by cognitive psychologists, such as Kuhn, Cheney, and Weinstock (2000), indicates that very few adults, let alone adolescents, develop critical-reasoning abilities in the ethical domain. Adolescents in particular can be especially rigid in their thinking. This rigidity can come in many forms. Some people tend to rely on rules and often resist delving deeply into the reasons for the rules or exploring whether there might ever be appropriate exceptions. The insistence on rules without reasons or exceptions is called *moral absolutism*.

Many people take a wholly subjective and relativistic stance, believing that it is impossible to assess whether one ethical opinion is any more justified than another. One position, which is called *ethical subjectivism*, is sometimes also stated this way: “It’s a free country; I have a right to my opinion, and you have a right to yours, and there is nothing more to discuss.” That statement shuts down thoughtful reflection and critical thinking. *Ethical relativism* is the view that the correct ethical opinion depends on, or is relative to, a particular culture or society.

Indeed, many people often confuse tolerance and respect for diversity—key features of a pluralistic society—with ethical subjectivism or ethical relativism. However, respect for diversity and critical thinking are not mutually exclusive. Individuals are free to make their own conclusions, but they should also strive to ensure that their beliefs are well informed and based on good reasons that can be explained to other people, especially people who may disagree with them.

#### How *Exploring Bioethics* Can Help

The next section, Tips for Conducting Ethics Discussions (page 14), contains many useful ideas for helping students avoid the traps of moral absolutism and ethical subjectivism or relativism. In addition, the modules include many pedagogical strategies to encourage students to think about the reasons for their choices and to engage respectfully with people who hold a broad range of views.

### Challenge #3: People’s Fear that Deeply Held Religious Beliefs Will Be Attacked

*Exploring Bioethics* does not aim to change students’ minds or challenge their deeply held beliefs, whether



those arise from their religious training or other sources. Rather, the goal is to enhance students' ability to provide reasons for their beliefs in light of the core ethical considerations introduced here. Most bioethics concepts have arisen within the major religious traditions of the world, so there are many commonalities between religious and ethics training. Ethical analysis gives people the opportunity to reflect on the underlying ethical considerations at the heart of most, if not all, religious teachings.

### How *Exploring Bioethics* Can Help

First, you may want to reiterate to students that the modules in this curriculum supplement do not aim to change their minds but, rather, to help them articulate the reasons for their views. Note that making solid and persuasive arguments is especially important if a student believes that everyone in society should follow his or her ethical standards. The next section of this guide, as well as Table 2 on pages 16 to 19, contains phrases you can use to encourage such reflection. In addition, all the activities include exercises and pedagogical strategies to encourage reflection.

### Challenge #4: Students Invoke Rights Instead of Offering Reasons

Rights language is often heard in U.S. classrooms because students recognize that describing something as a right is a way to argue that it is very important and worthy of respect. Another reason is that U.S. culture places great emphasis on personal freedom and liberty.

Rights language can, however, sometimes obscure the impact of one's decisions on other stakeholders or on community well-being as a whole. For example, without zoning rules that place limitations on individual landowners, some owners might believe that it is their right to do anything with their land they want to, including paving over wetlands or obstructing other people's views. Another good example has to do with laws that prohibit smoking in public places. As research revealed the serious harms to others of second-hand smoke, public health officials advocated for laws that limit smoking in places where others could be harmed.

Clearly, in contexts like these, there are good reasons to limit or balance individual rights with community well-being. Unfortunately, in typical conversations, people often use the term *right* or *rights* in an adamant way that may cut off further ethical debate.

### How *Exploring Bioethics* Can Help

Allowing a person to simply use rights language in an ethics discussion is usually counterproductive because too often it obscures the concern that the person is really trying to express. Encourage students to articulate their concerns in a more nuanced, descriptive way. Also, when your students assert individual rights, you should ask what the consequences may be for others.

Finally, note that philosophers usually link rights with obligations or duties. A right for a person to do or not to do something is usually seen to establish an obligation or duty for another person, group, or institution to protect that right by assisting with or refraining from interfering with that right. If students believe that something is a right, what obligations and duties do they think should be associated with that right?

### Challenge #5: Teachers May Find It Difficult to Facilitate Ethics Discussions

In addition to the broad challenges just identified, other issues make conducting ethics discussions difficult.

#### **People often try to avoid controversy and conflict.**

Discussions of some ethical issues can lead to controversy and even conflict. Since most people try to avoid conflict, they may wish to avoid discussion of these potentially contentious topics. Some teachers may avoid controversial discussions because they are concerned that certain students will dominate the conversation or that the discussion will get "out of control."

#### **Students may feel uncomfortable offering an unpopular view.**

Groups discussing ethical issues may fall prey to "group think," a phenomenon that gives the impression of consensus but that, in fact, masks a broader range of views. Good teaching in bioethics finds ways to encourage the expression of unpopular opinions and to protect those who hold them.

#### **Time for in-depth discussions is limited.**

Thinking like bioethicists takes time and insight, and arguments often emerge through intense discussion. Teachers have only limited opportunities to engage students in the rich, extended dialogue characteristic of the ways bioethicists do their best thinking.

## How *Exploring Bioethics* Can Help

For all these reasons, the next section (pages 14–19) outlines strategies for conducting ethics discussions.

## TIPS FOR CONDUCTING ETHICS DISCUSSIONS

### Establish Guidelines for Respectful Discussion

Establishing shared guidelines sets a tone in the classroom that emphasizes civility and mutual respect. You may either offer students a set of guidelines for appropriate behavior or brainstorm them with your students. If students develop a set of guidelines as a class, they are much more likely to feel ownership of them. Sample guidelines might include

- Critique ideas, not people.
- Monitor the amount of time that you speak.
- Avoid group think; respect the right of others to articulate unpopular views.

Try posting the most important guidelines in a prominent place, and discuss how the class will handle violations. After the first discussion, revisit the guidelines with the class to determine whether any were broken and to reinforce their importance. Spending the time to develop guidelines before engaging in controversial discussions often yields dividends later on.

### Encourage Quieter Students to Speak Up and Outspoken Students to Listen

The *Exploring Bioethics* modules provide a variety of strategies for supporting broad participation by all students. For example, having students write down their initial positions or discuss them in small groups before larger discussions take place gives quieter students a chance to share their positions in a nonthreatening way. Conversely, not allowing a free-form discussion helps limit the participation of those who monopolize the conversation.

### Protect Opinions Held by Only a Few Students

A student undergoes a high degree of social risk when voicing an unpopular opinion. Students may be afraid

to state their true positions because they believe that they will be ostracized or ridiculed. To protect those who hold views that differ from the majority of their classmates', it is necessary to cultivate a sense of safety in the classroom and to model the respectful recognition of different views. You might introduce *Exploring Bioethics* by saying that students will be entering into a time and space where views held by the many are not any more valuable than those held by the few. What matters is whether there is a strong justification for a view. The best way to arrive at a strong justification is to consider a variety of views, both the popular and the unpopular.

#### Prompt to convey that you welcome views held by only a few students

- “What would someone with a different point of view say? It need not be your personal position, but can you imagine someone seeing this in a different way?”

You will also signal the importance of diverse opinions if you swiftly quell inappropriate or disrespectful remarks one student makes about another's ideas.

Despite such encouragement to speak up, it may be easier for some students to represent the views of different stakeholders publicly and then to provide their own views in a followup written assignment. This strategy has the additional benefit of getting students to consider the arguments that different stakeholders, including those with unpopular views, might have.

In an ethics discussion, everyone benefits from the opportunity to examine an issue from multiple viewpoints. All serious suggestions ought to be carefully examined, and opinions should be listened to respectfully. Exposure to others' ideas helps refine thinking. New perspectives may reinforce or bring about change in a student's position. Valuable insight can be gained by discussing views that are unpopular or that represent a range of stakeholder concerns.

### Respond Thoughtfully to Students Who Invoke Religious Teachings

Students who come from strongly religious backgrounds may defer in a general way to the teachings of their religion saying, “That's just the way it has to be” or “My religion says so.” You may want to ask students what general ethical considerations underlie their positions so

they can see that such considerations are widely shared across different religions and cultures. Ask students who adopt positions based on religious beliefs to marshal the evidence that supports their positions, because some day, they may need to explain their positions to another person who may not have the same commitments. Note that making solid and persuasive arguments is especially important if the student believes that society at large should follow his or her ethical standards.

#### Prompts to encourage reflection

- “Yes, religion has many useful teachings, and deep, underlying ethical considerations often play a role in them.”
- “Which ethical considerations do you think are reflected in those teachings?”

## Respond Thoughtfully to Unrelenting Ethical Relativism

You must exercise care to help students avoid confusing tolerance with subjectivism and relativism. A clear indication that a student is experiencing this confusion is when you hear this: “I am entitled to my opinion and you’re entitled to your opinion, but no one opinion is better than any other.” Another common statement that shows confusion between tolerance and relativism is, “That’s the way it is done in their culture, so who am I to judge?” That statement precludes ethical assessment of slavery or genocide.

#### Prompts to help students move beyond a simplistic belief that all justifications are equally strong

- “Do you think that all justifications are equally strong? Why or why not?”
- “Is there ever any way to know which justifications are better? What is it?”
- “Are there certain practices that we can all agree are ethically wrong? If so, what are some examples? Why do we agree that these are ethically wrong?”

While you should encourage students to tolerate and respect many different views, they must recognize that not all behaviors are equally ethically appropriate and not all justifications are equally strong. In addition, students must be knowledgeable about justifications offered by other students so they can support or justify their own positions and explain how and why their

views may differ. They ought to be able to explain why they themselves hold this particular position rather than another, even if they believe that all such positions are simply a matter of personal belief or cultural custom. In addition, by listening to other viewpoints, they may come to see things differently.

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*Students must recognize that not all behaviors are equally ethically appropriate and not all justifications are equally strong.*

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## Respond to Students’ Blanket Insistence on Rights

During discussions, you may hear students say, “That’s just my right. It’s a free country, isn’t it?” Help students articulate the ethical considerations that underlie their belief that the intended behavior is a right. Also, help them see the implications for others.

#### Prompts to help students move beyond using rights as a term that may cut off further discussion

- “What if your exercising that right hurt your neighbor?”
- “You must see something here that is clearly important. Can you describe it?”
- “Which of the core ethical considerations do you think is at stake here?”
- “What duties or obligations should be associated with this right?”
- “If you exercised that right, what implications would it have for other individuals and for the community at large?”
- “What if every individual exercised that right? What implications would there be for other individuals and communities?”

## Encourage Careful Reasoning

Students may need extra support not only in providing reasons for their positions, but also in ensuring that their conclusions flow logically from their reasons. Prompt students to draw on the relevant scientific facts; the social, economic, and historical contexts; the core ethical considerations; other relevant considerations; and their own values in coming to their conclusions.

Prompts to encourage students to reflect on their reasons for a position

- “Why do you think that?”
- “What if we change one element of this scenario—would your thinking remain the same? Why? Why not?”
- “Are there any exceptions to the belief you have just expressed? What would make an exception justifiable in your mind?”

**Table 2** is meant to help guide you through potentially difficult situations in classroom discussions of bioethics. Specific suggestions for what you might say in a particular situation are aligned horizontally. It is very important to remember that you are helping students articulate their reasons, not seeking to build consensus in the classroom or to necessarily change students’ minds.

*You are helping students articulate their reasons, not seeking to build consensus or to necessarily change students’ minds.*

TABLE 2. TIPS FOR CONDUCTING ETHICS DISCUSSIONS

Table 2a. *Some students are dominating the discussion.*

How You Might Respond	Examples of What You Might Say
Remind the class that all students need to have their voices heard. If you and your students established norms for classroom discussion earlier, revisit those norms.	“Our discussions will be more powerful if all voices are heard. I’d like to pause and ask for contributions from people who haven’t yet had a chance to participate.”
<ul style="list-style-type: none"><li>• If hand raising is important to you, explain why.</li><li>• Remind students that you won’t necessarily call on the first person to raise his or her hand so that you can balance contributions from different students.</li></ul>	“I ask you to raise your hand so that there are pauses during which all students can formulate responses. Sometimes, you’ll find that you have a response right away, and other times, you’ll appreciate a few moments to stop and think. If people are calling out responses, it’s too difficult for others to thoughtfully consider a question or topic on their own.”
Give each student a certain number of plastic chips; each chip represents one chance to say something in a full-class discussion.	“You have three chips in front of you. Each time you add something to the full-class discussion, place one chip aside. Use this as a guide so that no one dominates the class discussion.”
Set up a comment box so that students have a way to contribute without always saying their comments aloud in front of the whole class. The next day, post the comments on the wall or start the class period by reading a few aloud.	“If you have a <i>very</i> important fourth comment, add it, but know that you need to carefully monitor how often you speak so that everyone gets a chance to participate. Use this box to add your additional good ideas. I’ll post them for everyone to see.”

**Table 2b. Some students rarely (if ever) participate.**

How You Might Respond	Examples of What You Might Say
<ul style="list-style-type: none"> <li>Remember that different students are reluctant to participate for different reasons. While some students may be quiet and shy in general, for example, others may not participate because they hold an unpopular opinion.</li> <li>Find ways for students to contribute to discussions anonymously. For example, tell them that in order to be dismissed from the classroom, each student must write down his or her (tentative) stance along with at least one reason in support of that stance. (They could place these in a comment box.) Then, you can present and discuss results at the beginning of the next class period.</li> <li>Remind students that they will maximize their learning by considering all perspectives on the issue at hand. Encourage them to raise perspectives that may or may not reflect their own personal stances. Establish a classroom culture in which all students listen to all ideas and where ideas—not people—are critiqued.</li> </ul>	<p>“Let’s use the following language: ‘<i>Someone might believe that...because....</i>’ This will take the emphasis off what you personally believe and ensure that it feels safe to offer all possible stances on this topic. In other words, don’t identify that opinion as your own, even if it does reflect what you personally believe.”</p>
<ul style="list-style-type: none"> <li>Before opening into a full-class discussion, try using a <i>think-pair-share</i> format. First, keep the class totally silent for a few minutes and have each student <i>think</i> and write down a few thoughts. Then, have students share in <i>pairs</i>, and then begin a full-class <i>share</i>.</li> <li>Direct very accessible questions to the quieter students to bring them into the discussion. After a think-pair-share, all students should have ideas ready.</li> </ul>	<p>Examples of accessible questions:</p> <p>“Let’s brainstorm words that you associate with ‘fairness’.”</p> <p>“Here’s an image that relates to this discussion. What’s something you notice in this image?” (Students think individually, and then share in pairs.) Then, “Charlie, now that you’ve had a chance to think on your own and in a pair, what is something you noticed in this image?”</p>

**Table 2c. Students with unpopular views feel vulnerable sharing them.**

How You Might Respond	Examples of What You Might Say
<p>Let the class know that bioethics can’t be successful if people discuss only one point of view.</p>	<p>“I won’t consider it a success if all of you agree all the time. If you hold an opinion that you think other students might not like, I hope you’ll be brave enough to share it, and I hope that the rest of us will be brave enough to hear it. Who’s willing to share a view even if it’s unpopular?”</p>



**Table 2d. Students say they already have a strong opinion because of their religion.**

How You Might Respond	Examples of What You Might Say
Craft a response that respects religious beliefs and makes it clear that you are not trying to build consensus within the classroom or to change students' minds. Your response should emphasize the need for students to provide reasons to support their positions.	"It's fine that you already have an opinion. The goal here is not for me or anyone else in this room to change your mind. However, the class discussions and activities give you the chance to express more reasons that support your opinion. We'll be discussing ethical considerations like respect, fairness, and minimizing harms while maximizing benefits to people, and you'll be able to use these considerations, which often arise within religious teachings, to support your opinion. By listening to other students' opinions, you'll be able to further develop your own thinking and provide more reasons for your own opinion."

**Table 2e. Students are stuck thinking that all positions are equally valid and that ranking them is impossible.**

How You Might Respond	Examples of What You Might Say
Give a very concrete example to help students confront situations that they would probably deem unfair or unacceptable—such as a teacher giving a grade of "D" to papers of all students whose name begins with a vowel. Then, after students have had a chance to respond, help them make the connection: it's good to see that there can be a wide range of ethically accepted positions, but some positions are better justified than others.	<p>"Suppose you've been waiting in line for a very long time for tickets to an event. Someone comes along and hops right to the front of the line. You voice your discontent, and the person who jumped to the front comments that 'everyone is allowed to do what they want.' What might you say in response to engage this person in a constructive and meaningful dialogue?" (Student responds ... ) Then, "How does this 'jumping-to-the head-of-the-line' example relate to bioethics?"</p> <p>Or, "What if I decided to assign random grades to your papers? How would you react? Are all practices really equally okay?"</p> <p>"Let's put this specific issue aside for a moment and think more broadly. Are there certain practices in the world that are ethically wrong? If so, what are some examples? Why are these ethically wrong?"</p>
Ask probing questions to help students reconsider whether or not all arguments are equally good and how important it is to give reasons in support of a stance.	<p>"Here are two positions on a completely different issue ... . Which has better supporting evidence or reasons?"</p> <p>"What does it mean for a justification or reason to be well-developed? Why is it important for your reasons to be well-developed?"</p> <p>"It may not always be possible to know what is best, but it is usually possible to distinguish between 'better' and 'worse' justifications."</p>
Some students might think it's rude to critique another student's thinking. Explain that discussions and critiques are not rude as long as students focus on the reasons being discussed and do not mock them.	"It's not rude to assess someone's arguments; rather, judging some positions and the reasons given for them is what educated and informed people should do."



**Table 2f. Students argue that a person has a right to do or not to do something and cannot elaborate further.**

How You Might Respond	Examples of What You Might Say
Acknowledge that students are discussing something—an activity or state of being—that is very important to them.	“Clearly, you care deeply about this topic; either it’s very important to you, or you think it’s something very important to the person in this situation.”
Ask students whether they are asserting a legal, ethical, or social right (or some combination of the three).	“Is this right something that you know is already a law or something that should be a law? Is it simply a practical matter that the law can take care of? Or does this right also have some foundation in what’s the right thing to do from an ethical perspective?”
If students have an ethical right in mind, try to find out whether the right stems from a concern for respect for persons, a need to maximize benefits while minimizing harms, or a desire to ensure fairness for all involved in the situation.	“Can you tell me more about this right? What are its features? Are you trying to be sure that the person in the situation will receive respect for personal decisions or choices? Are you trying to be sure that this person is not harmed or receives some benefits from the situation?”
Explain to students that to protect one person’s rights, another person, group of people, or institution has the obligation to help protect and enforce those rights. Ask whether students can identify who or what would bear the obligation that corresponds to the right they are articulating.	“Usually, the ability to enjoy a right to do something or not means that someone else, a group of people, or an institution has the obligation to protect or enforce that right. Who or what do you think would be responsible for helping ensure that you can enjoy the right you are describing?”
Ask what the consequence for others, or the community as a whole, would likely be if individuals acted on this right.	“It’s one thing to assert that someone has the right to do something, but it’s important to also think about the consequences for others. Who (or what) else might be affected, if all individuals had this right?”

**Table 2g. Students quickly take a position but cannot provide reasons for or exceptions to it.**

How You Might Respond	Examples of What You Might Say
Use open-ended questions to help students elaborate on what they are thinking. This sort of question reserves judgment and simply helps students continue their thought process.	“Tell me more about that. I’d like to understand more about what you’re thinking and why you think so.”
Ask probing questions that help facilitate students’ thought processes without doing the thinking on their behalf. In other words, these questions should help students clarify their thinking and come up with reasons to support their stances. These questions should not provide reasons for students but should help students craft their own reasons.	<p>“Would this always be the case? Can you think of any exceptions? Why would these be exceptions?”</p> <p>“What makes this example different from ... ?”</p> <p>“You seem to be saying that ... . How would your response be different if ... ?”</p> <p>“What questions might someone have about your stance? How would you reply?”</p> <p>“Here’s the opposite viewpoint ... . If you met someone with this viewpoint, how would you defend your own viewpoint?”</p>

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# About the Modules

## GOALS

The purpose of this curriculum supplement is to introduce students to bioethics as a field of inquiry and to enable them to develop ethical reasoning skills so they can move beyond “gut reactions” to more nuanced positions. The supplement will help students achieve the five major goals outlined below.

### Goal 1

**Recognize the interrelationship among science, society, and ethical considerations.**

Students will understand that the process and discoveries of science have social and ethical implications that an informed public and scientists need to address. They will also recognize how scientific data can and should inform ethical analysis and public policy making.

### Goal 2

**Develop the ability to recognize important bioethics concepts and ways of thinking.**

Students will understand that the four key questions and relevant ethical considerations can guide them as they analyze bioethical issues.

### Goal 3

**Develop critical-reasoning skills, especially the ability to justify an ethical position.**

Students will cultivate habits of mind and skills so that they can reason about ethical issues and develop well-informed, well-thought-out reasons. These skills include being able to identify ethical questions, gather relevant scientific facts, consider who or what could be affected by the way questions get resolved, identify relevant ethical considerations and apply them to the problem, and justify a position in line with these considerations. Students should also consider whether their justifications for their positions on different issues are consistent.

### Goal 4

**Recognize the importance of scientific knowledge in bioethical decision making.**

Students will understand the importance of applying scientific knowledge to making informed decisions about bioethical issues. The curriculum supplement gives students the chance to apply and reinforce important science concepts and enhances their appreciation of and interest in learning science.

### Goal 5

**Enhance respectful dialogue among individuals with diverse perspectives.**

Students will grow in their capacity to discuss controversial issues with civility and respect for different viewpoints, thus preparing them to be better citizens in a democratic, pluralistic society. Students should also realize that their personal values are shaped by their cultural context.

## OVERVIEW OF THE MODULES

**Table 3** (pages 22–23) summarizes the ethical issues and curricular connections for each module.

This supplement comprises six modules. Module 1 is an introduction to bioethics and to this supplement. It is important to teach Module 1 first because it presents a conceptual framework that students will apply in all the later modules.

Modules 2 to 6 can be taught in any order. The framework presented in Module 1 includes four key questions and core ethical considerations, which are common issues that people ought to take into account when faced with an ethical choice.

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*It is important to teach Module 1 first because it presents a conceptual framework that students then go on to apply in all the later modules.*

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TABLE 3. ETHICAL ISSUES AND CURRICULAR CONNECTIONS

Module	Ethical Issues*	Curricular Connections
<b>1. Bioethics Concepts and Skills</b>	This module introduces a problem-solving approach that students can use when faced with ethical decisions. It includes answering four key questions and paying attention to core ethical considerations ( <b>respect for persons, harms and benefits, and fairness</b> ). Each student uses these questions and considerations to develop a well-reasoned justification about the ethics of enhancement in sports. Extension opportunities promote discussion of other kinds of enhancements in cognitive and artistic performance. This module should be taught first because it introduces a method of bioethical inquiry that will be applied to all the other topics.	<ul style="list-style-type: none"> <li>• Nature of science (empiricism)</li> <li>• Steroids and hormones</li> </ul>
<b>2. Balancing Individual and Community Claims: Establishing State Vaccination Policies</b>	Module 2 emphasizes the core ethical considerations of <b>respect for persons</b> and <b>fairness</b> , and students wrestle with the tension between individual freedom and community well-being. Each student must determine, and justify, how he or she would balance individual and community claims about a hypothetical community controversy involving mandatory school vaccination policies.	<ul style="list-style-type: none"> <li>• Community (herd) immunity</li> <li>• Epidemic</li> <li>• Information about specific diseases</li> <li>• Interpreting data</li> <li>• Nature of infectious disease</li> <li>• Vaccines: impacts, benefits, and risks</li> <li>• Vaccines and immunologic memory</li> <li>• Viruses and bacteria</li> </ul>
<b>3. Allocating Scarce Resources: The Case of Organ Transplantation</b>	After briefly exploring a range of historical cases in which decisions had to be made about the allocation of a scarce biomedical technology, students focus on the task of fairly distributing organs that are in short supply. With the consideration of <b>fairness</b> in mind, each student must take a fully justified stance about what he or she sees as the fairest distribution policy.	<ul style="list-style-type: none"> <li>• Immunology: factors that determine whether an organ is a good match</li> <li>• Liver: function, reasons for failure, transplant statistics</li> <li>• Organ systems</li> <li>• Transplant basics: which organs or tissues can get transplanted? What factors ensure a better outcome?</li> </ul>
<b>4. Weighing Benefits and Harms: Ethical Issues in Genetic Testing</b>	Students consider <b>respect for persons</b> and recognize and weigh all <b>harms and benefits</b> in order to make a fully justified recommendation about genetic testing for a teenage member of a hypothetical family. Because some of the genetic tests are predictive rather than diagnostic, each student also grapples with how best to proceed given the inherent uncertainty of the situation.	<ul style="list-style-type: none"> <li>• Alzheimer's disease</li> <li>• Cancer biology</li> <li>• DNA: structure and mutations</li> <li>• Genetic testing: predictive vs. diagnostic</li> <li>• Mendelian genetics: recessive vs. dominant</li> <li>• Mutations: inherited vs. somatic</li> <li>• Pedigree interpretation</li> <li>• Relationship among genes, proteins, and traits</li> </ul>

*Continued*

Module	Ethical Issues*	Curricular Connections
<b>5. Research Ethics: The Power and Peril of Human Experimentation</b>	Students learn that research with humans has led to widespread <b>benefits</b> but can also lead to abuse and <b>harms</b> if certain protections are not in place. Students consider factors that make research most <b>respectful</b> of all individuals, including ensuring voluntary and informed consent.	<ul style="list-style-type: none"> <li>• Nature of science: research design, how experiments are done, the need to test one variable at a time, the need for comparison (or control) groups, and intervention vs. observational studies</li> <li>• Study design: controlled studies, placebos, randomization, and blinding</li> </ul>
<b>6. Modifying the Natural World: Human Responsibilities toward Animals</b>	Students examine human <b>responsibilities</b> to the rest of the natural world, particularly with respect to the modification of animals for human purposes. They grapple with <b>harms and benefits</b> to animals and humans and whether <b>respect for persons</b> should be adapted and extended to other species. Because scientists might not yet completely understand the modification's effect on the animal or on the environment, each student must grapple with uncertainty when justifying his or her decision about which kinds of modifications to animals are and are not ethically appropriate.	<ul style="list-style-type: none"> <li>• DNA, RNA, protein, traits</li> <li>• Ecosystem</li> <li>• Genetic modification and gene insertion methods</li> <li>• Implications of scientific interventions</li> <li>• Mutation</li> <li>• Phenotype, genotype</li> <li>• Population dynamics</li> <li>• Selective breeding, monoculture</li> </ul>

\*Although each module touches on each of the three core ethical considerations (respect for persons, minimizing harms while maximizing benefits, and fairness), the most relevant considerations within each module are noted in **bold**.

## USING THE MODULES

As you review the modules, you will find that each one contains several major features.

**At a Glance** summarizes the module.

- **Issues Explored:** States the overarching ethical issues the module addresses.
- **Purpose and Rationale:** Provides the why of the module—the reason why students are investigating a particular topic.
- **Overview:** Offers a general picture of the entire module.
- **Learning Objectives:** Lists what students will know and understand by the end of the module.
- **Major Concepts:** Lists the scientific and ethics concepts covered in the module.

- **Assessment Outcome:** Describes a final assignment to ensure that students take a position on the issue and fully justify their stance.
- **Key Science Knowledge:** Lists the scientific concepts covered in the module and highlights those that are explicitly addressed.
- **Teaching Sequence Preview:** Provides a day-by-day preview of what students will do.

**In Advance** offers lists of the items needed to carry out the module. These include photocopies and transparencies, materials and equipment, masters, and teacher support materials. Each module is divided into three days of class, each about 45 minutes long.



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*Each module is divided into three days of class, each about 45 minutes long.*

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The day begins with a description of the purpose of that day's activities and which of the four key questions and ethical considerations students will take up that day, followed by these sections:

- **Activities to introduce the issue** that capture students' interest and solicit their preconceptions.
- **Readings and discussions** that convey scientific and ethical content to students and promote communication and exchange of ideas.
- **Cases** to allow in-depth student consideration of the ethical issues at hand.
- **Activities to facilitate full student engagement and promote critical thinking, the application of scientific and ethical concepts, and analysis** (kinesthetic discussion techniques, simulations, role plays, games, etc.).
- **Ongoing personal reflections and end-of-module assessment** activities to ensure that each student takes a fully justified position on the issue .
- **Teaching Strategies** that offer support for implementation, alternative approaches to the activities, and options for different learners.
- **Extensions** that offer optional activities that allow students to pursue a particular topic in greater depth.
- **Organizers** that appear at the end of each day and provide a quick view of the procedure steps of each activity, including icons that notify you when you will need to make masters and transparencies.

**Icons** appear throughout the activities. They alert you to teaching aids that can help you implement the activities and enrich student learning.



#### Assessment

Indicates steps in the activities that you can use as assessments, including informal indicators of student understanding, and the final assessment at the end of the module.

#### Ethical Considerations

RESPECT  
FOR PERSONS

Indicates where in the text a particular ethical consideration is covered in depth.

HARMS  
AND BENEFITS

FAIRNESS

RESPONSIBILITY

AUTHENTICITY



#### More on the Web

Indicates when further student or teacher support is available on the Web.



#### Note

Offers further explanations, teaching hints, or implementation suggestions.



#### See Module 1

Reminds you to complete Module 1 with your students before starting any of the others.



#### See the Introduction

Indicates when you can find further information in the Introduction about a particular feature, which you should be sure to refer back to.



#### See Teacher Support Materials

Indicates when teacher support materials are available. The materials are only on the Web site, so the See Teacher Support Materials icon is always accompanied by a More on the Web icon (www.). These materials include answer keys and in-depth ethics content. They are important and very helpful. Check them out! Go to <http://science.education.nih.gov/supplements/bioethics/teacher>.



#### Tip from the Field

Indicates when teachers from the field test had information that could be helpful as you implement the module.



**References and Resources** appears at the end of each module. It lists the sources used in the module and resources to go to for further information.

**Masters** to be photocopied for students are located at the end of each module as well as on the Web site.

**Teacher Support Materials**—including answer keys, background information on different topics, and extension activities—are available on the Web site: <http://science.education.nih.gov/supplements/bioethics/teacher>.

## ALTERNATIVE WAYS TO IMPLEMENT THE MODULES

You should begin with Module 1, because it provides the background necessary for student understanding of the subsequent modules. However, you can teach Modules 2 to 6 in any order. **Table 3** on pages 22 to 23 summarizes the ethical issues the modules highlight and their connections to topics in biology.

Each module consists of three 45-minute class sessions and, usually, some homework. You can teach each module's three days consecutively or integrate pieces of the modules into existing units. You can use a scenario from a module as an introduction to one of your biology units, teach that unit, and then return to the remaining ethics sessions at the end.

For example, Module 4 addresses the topic of genetic testing, so you could integrate it into an existing Mendelian genetics unit. Day 1 of Module 4 could begin the genetics unit. Although students would not yet have an understanding of recessive and dominant modes of inheritance, they could grasp the idea of the purpose of a genetic test and would likely be drawn into the unit by discussing some of the related ethical issues. Furthermore, students would be likely to ask questions about inheritance patterns while working through Day 1. From there, the class could transition into the unit on genetics, and the pedigrees from Day 2 could be integrated into the discussion of inheritance. Toward the end of the unit, students could tackle Day 3 of the module and complete the final assessment. In this way, the bioethics module becomes a “wrap-around” for the longer genetics unit.

## CORRELATING *EXPLORING BIOETHICS* WITH NATIONAL SCIENCE EDUCATION STANDARDS AND STATE STANDARDS

The National Science Education Standards (NSES), developed by the National Research Council (1996), describe the content every student should know and the inquiry skills every student should master. **Tables 4** and **5** indicate the alignment of *Exploring Bioethics* with the grades 9–12 standards. Alignment of the supplement with every state's science, math, and English language arts standards is available online at <http://science.education.nih.gov/statestandards>.

TABLE 4. ALIGNMENT WITH NSES LIFE SCIENCE CONTENT STANDARDS

<b>LIFE SCIENCE</b> <b>Standard C: As a result of their activities in grades 9–12, all students should develop understanding of</b>	<b>Correlation to <i>Exploring Bioethics</i></b>
<b>The Cell</b>	
<ul style="list-style-type: none"> <li>Most cell functions involve chemical reactions. Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by a large set of protein catalysts, called enzymes. The breakdown of some of the food molecules enables the cell to store energy in specific chemicals that are used to carry out the many functions of the cell.</li> </ul>	Module 6
<ul style="list-style-type: none"> <li>Cells store and use information to guide their functions. The genetic information stored in DNA is used to direct the synthesis of the thousands of proteins that each cell requires.</li> </ul>	Modules 4, 6
<ul style="list-style-type: none"> <li>Cell functions are regulated. Regulation occurs both through changes in the activity of the functions performed by proteins and through the selective expression of individual genes. This regulation allows cells to respond to their environment and to control and coordinate cell growth and division.</li> </ul>	Modules 3, 4, 6
<ul style="list-style-type: none"> <li>Cells can differentiate, and complex multicellular organisms are formed as a highly organized arrangement of differentiated cells. In the development of these multicellular organisms, the progeny from a single cell form an embryo in which the cells multiply and differentiate to form the many specialized cells, tissues, and organs that comprise the final organism. This differentiation is regulated through the expression of different genes.</li> </ul>	Modules 4, 6
<b>The Molecular Basis of Heredity</b>	
<ul style="list-style-type: none"> <li>In all organisms, the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (A, G, C, and T). The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular “letters”) and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome.</li> </ul>	Modules 4, 6
<ul style="list-style-type: none"> <li>Most of the cells in a human contain two copies of each of 22 different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contains two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and a sperm unite to form a new individual. The fact that the human body is formed from cells that contain two copies of each chromosome—and therefore two copies of each gene—explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next.</li> </ul>	Module 4
<ul style="list-style-type: none"> <li>Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organism, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism’s offspring.</li> </ul>	Modules 4, 6
<b>Matter, Energy, and Organization in Living Systems</b>	
<ul style="list-style-type: none"> <li>All matter tends toward more disorganized states. Living systems require a continuous input of energy to maintain their chemical and physical organizations. With death, and the cessation of energy input, living systems rapidly disintegrate.</li> </ul>	Module 3
<ul style="list-style-type: none"> <li>The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between atoms (chemical energy) can be used as sources of energy for life processes.</li> </ul>	Module 6
<b>The Behavior of Organisms</b>	
<ul style="list-style-type: none"> <li>Behavioral biology has implications for humans, as it provides links to psychology, sociology, and anthropology.</li> </ul>	Modules 1, 2, 3, 5

TABLE 5. ALIGNMENT WITH OTHER NSES CONTENT STANDARDS

Other Content Standards	Correlation to <i>Exploring Bioethics</i>
<b>SCIENCE AS INQUIRY</b> <b>Standard A: As a result of activities in grades 9–12, all students should develop</b>	
Abilities necessary to do scientific inquiry	Modules 1–6
Understandings about scientific inquiry	Modules 1–6
<b>SCIENCE AS TECHNOLOGY</b> <b>Standard E: As a result of activities in grades 9–12, all students should develop</b>	
Abilities of technological design	Modules 3–6
Understandings about science and technology	Modules 1–6
<b>SCIENCE IN SOCIAL AND PERSONAL PERSPECTIVES</b> <b>Standard F: As a result of activities in grades 9–12, all students should develop understanding of</b>	
Personal and community health	Modules 1–6
Population growth	Module 6
Natural and human-induced hazards	Modules 2–6
Science and technology in local, national, and global challenges	Modules 1–6
<b>HISTORY AND NATURE OF SCIENCE</b> <b>Standard G: As a result of activities in grades 9–12, all students should develop understanding of</b>	
Science as a human endeavor	Modules 1–6
Nature of scientific knowledge	Modules 1–6
Historical perspectives	Modules 1–6

## About the Web Site

The Web site for Exploring Bioethics includes PDF and HTML versions of the entire supplement, updates, and corrections, as well as a PowerPoint presentation and extension activities. To access the site, go to <http://science.education.nih.gov/supplements/bioethics>.

### Hardware and Software Requirements

The site can be accessed from Apple Macintosh and IBM-compatible personal computers. The recommended hardware and software requirements for using the site are listed below.

#### PC

- Pentium III 600 MHz IBM compatible with Windows 2000 or higher, with 256 MB RAM
- Browser compatibility: Mozilla Firefox 2.0 or higher, Internet Explorer 6.0 or higher

#### MAC

- G4 Macintosh with Mac OS 9 or newer, with 256 MB RAM
- Browser compatibility: Mozilla Firefox 2.0 or higher, Safari 3.0 or higher

#### General

- Screen resolution of 1024 by 768 pixels
- 56 kbps modem or high-speed Internet connection
- Free hard drive space: 10 MB
- Browser settings: JavaScript enabled
- Adobe Reader, downloadable for free from <http://www.adobe.com>

### State Standards Alignment

To find out how this supplement's content aligns with your state's science, English language arts, and math education standards, go to <http://science.education.nih.gov/StateStandards>.

### Web Materials for People with Disabilities

The Office of Science Education (OSE) provides access to the Curriculum Supplements Series for people with disabilities. The online versions of this series comply with Section 508 of the Rehabilitation Act. If you use assistive technology (such as a Braille reader or a screen reader) and have trouble accessing any materials on our Web site, please let us know. We'll need a description of the problem, the format in which you would like to receive the material, the Web address of the requested material, and your contact information.

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